CLAIMS:

What is claimed is:

5   1.   A method comprising:

filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples;

determining from the residual signal frame at least one pitch cycle within the 10   residual frame;

applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles; and

synthesizing a second speech signal from the modified residual frame and the 15   set of vocal tract model parameters, whereby the second speech signal is a pitch-compensated speech signal.

2.   The method of claim 1, wherein the integer number of pitch cycles is a predetermined integer number of pitch cycles.

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3.   The method of claim 2, wherein the integer number of pitch cycles is predetermined to be one.

4.   The method of claim 1, wherein the transformation function changes a time 25   scale of a residual signal represented by the residual signal frame.

Docket No. YOR920030110US1

5.   The method of claim 4, wherein the transformation function changes the time scale of the residual signal by performing operations that include:

selecting a set of samples from the residual signal, wherein the set of samples is a consecutive sequence of samples taken from the residual signal, such that the set

5   of samples corresponds to a contiguous interval of time in the residual signal;

performing linear interpolation between samples in the first set of samples so as to model the residual signal over said contiguous interval of time as a piecewise linear function; and

generating the modified residual signal by generating a new sequence of

10   samples from the piecewise linear function such that the cardinality of the new sequence of samples is equal to the same fixed number of samples as contained in the residual signal frame.

6.   The method of claim 4, wherein the transformation function changes the time

15   scale of the residual signal by performing a non-linear time warping operation on an interval of the residual signal so as to find a correspondence between samples from the interval of the residual signal and samples in a reference signal.

7.   The method of claim 6, wherein the non-linear time warping operation is

20   performed according to a dynamic time warping algorithm.

8.   The method of claim 1, wherein the transformation function generates a modified residual signal frame from the residual signal frame by performing operations that include:

25   mapping to zero a first subset of samples from a residual signal represented by the residual signal frame; and

mapping a second subset of samples from the residual signal to their identical values.

9.   The method of claim 1, further comprising:

cyclically shifting samples in the modified residual signal frame so as to normalize a phase of the modified residual signal frame.

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10.   The method of claim 1, further comprising:

feeding the modified residual signal frame to at least one of speech recognition software and speaker recognition software.

10 11.   A computer program product in a computer-readable medium comprising functional descriptive material that, when executed by a computer, causes the computer to perform acts that include:

filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and
15 the residual signal frame contain a same fixed number of samples;

determining from the residual signal frame at least one pitch cycle within the residual frame;

applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of
20 pitch cycles; and

synthesizing a second speech signal from the modified residual frame and the set of vocal tract model parameters, whereby the second speech signal is a pitch-compensated speech signal.

25 12.   The computer program product of claim 11, wherein the integer number of pitch cycles is a predetermined integer number of pitch cycles.

13.   The computer program product of claim 12, wherein the integer number of pitch cycles is predetermined to be one.

5   14.   The computer program product of claim 11, wherein the transformation function changes a time scale of a residual signal represented by the residual signal frame.

15.   The computer program product of claim 14, wherein the transformation

10   function changes the time scale of the residual signal by performing operations that include:

selecting a set of samples from the residual signal, wherein the set of samples is a consecutive sequence of samples taken from the residual signal, such that the set of samples corresponds to a contiguous interval of time in the residual signal;

15   performing linear interpolation between samples in the first set of samples so as to model the residual signal over said contiguous interval of time as a piecewise linear function; and

generating the modified residual signal by generating a new sequence of samples from the piecewise linear function such that the cardinality of the new

20   sequence of samples is equal to the same fixed number of samples as contained in the residual signal frame.

16.   The computer program product of claim 14, wherein the transformation function changes the time scale of the residual signal by performing a non-linear time

25   warping operation on an interval of the residual signal so as to find a correspondence between samples from the interval of the residual signal and samples in a reference signal.

Docket No. YOR920030110US1

17.   The computer program product of claim 16, wherein the non-linear time warping operation is performed according to a dynamic time warping algorithm.

18.   The computer program product of claim 11, wherein the transformation
5   function generates a modified residual signal frame from the residual signal frame by performing operations that include:

mapping to zero a first subset of samples from a residual signal represented by the residual signal frame; and

mapping a second subset of samples from the residual signal to their identical
10   values.

19.   The computer program product of claim 11, comprising additional functional descriptive material that, when executed by the computer, causes the computer to perform additional acts that include:
15   cyclically shifting samples in the modified residual signal frame so as to normalize a phase of the modified residual signal frame.

20.   The computer program product of claim 11, comprising additional functional descriptive material that, when executed by the computer, causes the computer to
20   perform additional acts that include:

feeding the modified residual signal frame to at least one of speech recognition software and speaker recognition software.

21.   A data processing system comprising:
25   means for filtering a frame of a first speech signal to obtain a residual signal frame and a set of vocal tract model parameters, wherein the frame of the first speech signal and the residual signal frame contain a same fixed number of samples;

means for determining from the residual signal frame at least one pitch cycle

within the residual frame;

means for applying a transformation function to the residual frame to obtain a modified residual frame, wherein the modified residual frame contains an integer number of pitch cycles; and

5   means for synthesizing a second speech signal from the modified residual frame and the set of vocal tract model parameters,

whereby the second speech signal is a pitch-compensated speech signal.

22.   The data processing system of claim 21, wherein the integer number of pitch
10 cycles is a predetermined integer number of pitch cycles.

23.   The data processing system of claim 22, wherein the integer number of pitch cycles is predetermined to be one.

15 24.   The data processing system of claim 21, wherein the transformation function changes a time scale of a residual signal represented by the residual signal frame.

25.   The data processing system of claim 24, wherein the transformation function changes the time scale of the residual signal by performing operations that include:
20 selecting a set of samples from the residual signal, wherein the set of samples is a consecutive sequence of samples taken from the residual signal, such that the set of samples corresponds to a contiguous interval of time in the residual signal;

performing linear interpolation between samples in the first set of samples so as to model the residual signal over said contiguous interval of time as a piecewise
25 linear function; and

22

generating the modified residual signal by generating a new sequence of samples from the piecewise linear function such that the cardinality of the new sequence of samples is equal to the same fixed number of samples as contained in the residual signal frame.

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26.   The data processing system of claim 24, wherein the transformation function changes the time scale of the residual signal by performing a non-linear time warping operation on an interval of the residual signal so as to find a correspondence between samples from the interval of the residual signal and samples in a reference signal.

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27.   The data processing system of claim 26, wherein the non-linear time warping operation is performed according to a dynamic time warping algorithm.

28.   The data processing system of claim 21, wherein the transformation function

15   generates a modified residual signal frame from the residual signal frame by performing operations that include:

        mapping to zero a first subset of samples from a residual signal represented by the residual signal frame; and

        mapping a second subset of samples from the residual signal to their identical

20   values.

29.   The data processing system of claim 21, further comprising:
        means for cyclically shifting samples in the modified residual signal frame so as to normalize a phase of the modified residual signal frame.

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30.   The data processing system of claim 21, further comprising:
        means for feeding the modified residual signal frame to at least one of speech recognition software and speaker recognition software.